

THORAX

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- Thorax is the region of the body between neck & abdomen.
- Communicates above with the neck & separated below from the abdomen by the diaphragm.

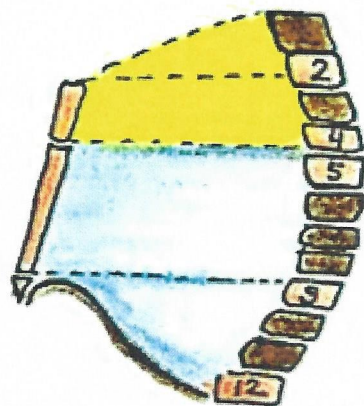
Lines of orientation :-

- 1) Midsternal line :- is the line in the median plane over sternum.
- 2) Midclavicular line :- vertical line from midpoint of the clavicle.
- 3) Ant. axillary line :- vertical line from anterior axillary fold.
- 4) Post. axillary line :- vertical line from posterior axillary fold.
- 5) Mid-axillary line :- vertical line midway between ant. & post. axillary folds.
- 6) Scapular line :- vertical line on post. thoracic wall passing through inf. angle of scapula.



Formation of thoracic wall :-

- Posteriorly :- thoracic vertebrae.
- Anteriorly :- Sternum & costal cartilages.
- Laterally :- ribs & intercostal spaces.
- Superiorly :- suprapleural membrane.
- Inferiorly :- Diaphragm.



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The levels & Planes of thorax :-

- Suprasternal notch: lies opposite lower border ^{body} T₂
- Sternal angle (angle of Louis) (manubrio-sternal ^{junct.} angle) lies opposite disc between T₄-T₅.

- Xiphi-sternal junction: lies opposite body of T₉

- Thoracic inlet: between upper border of manubrium (suprasternal notch) and upper border of body of T₁ vertebra.

- clinically called thoracic outlet.

- Boundaries: posterior: 1st thoracic vertebra (T₁).

- anterior: upper border of manubrium sterni.

- laterally: medial borders of 1st ribs & their costal cartilages

- structures pass through inlet → see later.

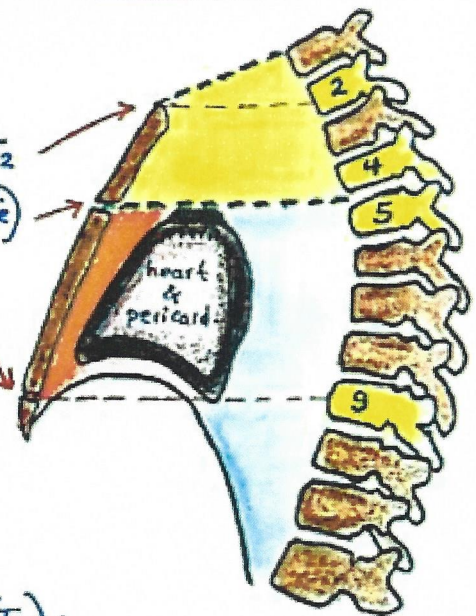
- Thoracic outlet: between xiphoid process & T₁₂, facing downward-forward.
- clinically called thoracic inlet, closed by diaphragm.

- Boundaries: posterior: 12th thoracic vertebra (T₁₂).

- anterior: xiphi-sternal joint.

- laterally: ribs & costal cartilages from rib 7-12.

- structures pass through outlet → see later.



Cut. innervation of chest wall :-

• above sternal angle:-

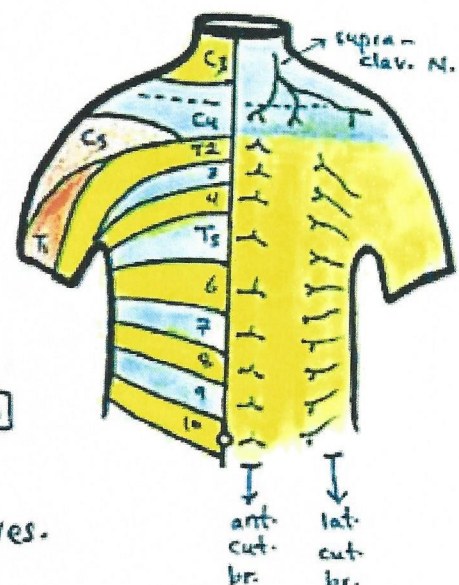
- skin is supplied by supraclavicular N. (C_{3,4})

• below sternal angle:-

- skin is supplied ^{obliquely} segmentally by ant. and lateral cut. branches of intercostal nerves from T₂ → to T₁₂ (T₁ no cut. branches in thorax)
- [NB:- T₁₀ supplies level of umbilicus in abdomen]

• skin of post. chest wall:-

- supplied by post- rami of thoracic nerves.



* Surface landmarks of thoracic wall :-

A- On anterior wall :-

- ① Suprasternal notch :- opposite lower border of T₂.
- ② Sternal angle :- opposite I.V disc between T₄-T₅.
- ③ Xiphisternal joint :- opposite body of T₉ vertebra.
- ④ Subcostal angle :- angle between sternal attachment of the 7th costal cartilage.
- ⑤ Costal margin :- the lower edge of thorax formed by ribs from 7th to 10th.
- ⑥ Nipple :- in male lies in 4th intercostal space about 10 cm from midline (female not constant).
- ⑦ Apex of heart :- lies in Lt 5th intercostal space about 9 cm from midline (3.5 inches).

B- on posterior wall :-

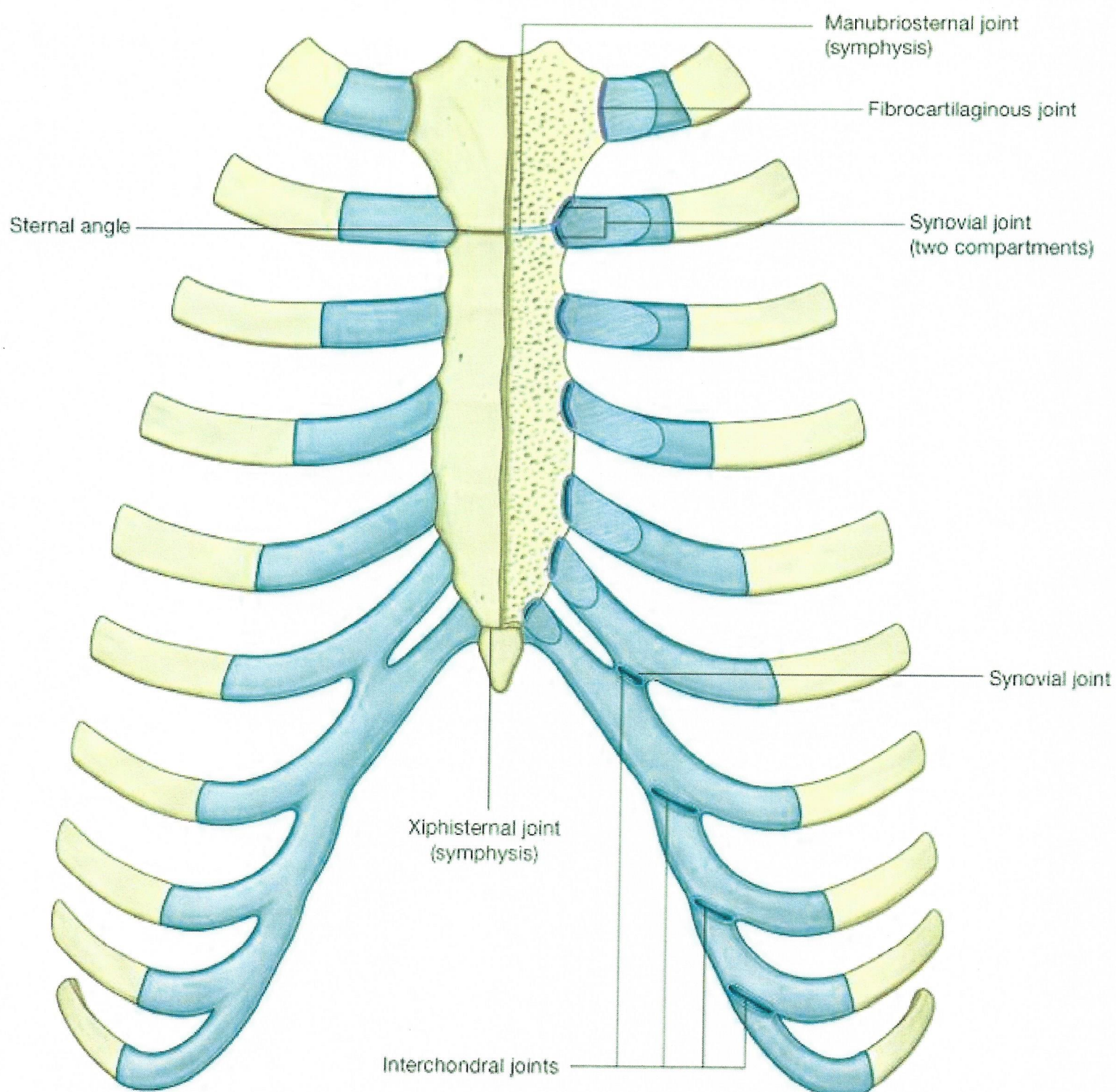
- ① the 1st spine to be felt is C₇ (vertebral prominence)
- ② spine from C₁ - C₆ can not be felt as it marked by thick ligamentum nuchae.
- ③ spine of T₂ opposite to superior angle of scapula.
- ④ spine of T₃ " " root of spine of " "
- ⑤ spine of T₇ " " inferior angle of " "



NB :- the tip of spine lies opposite to body of the next vertebra below

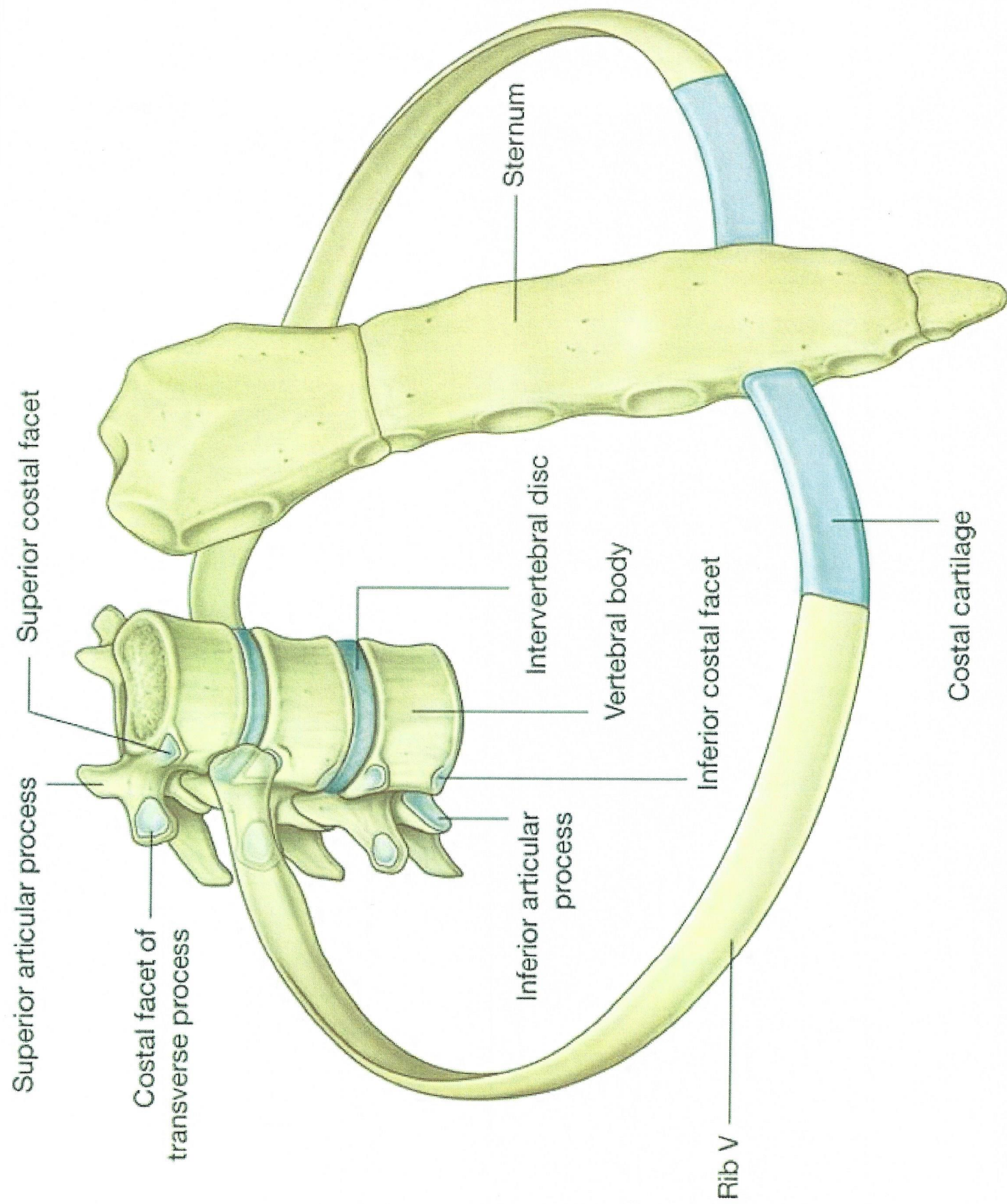
N.B - Clavicle is subcutaneous & easily palpated.

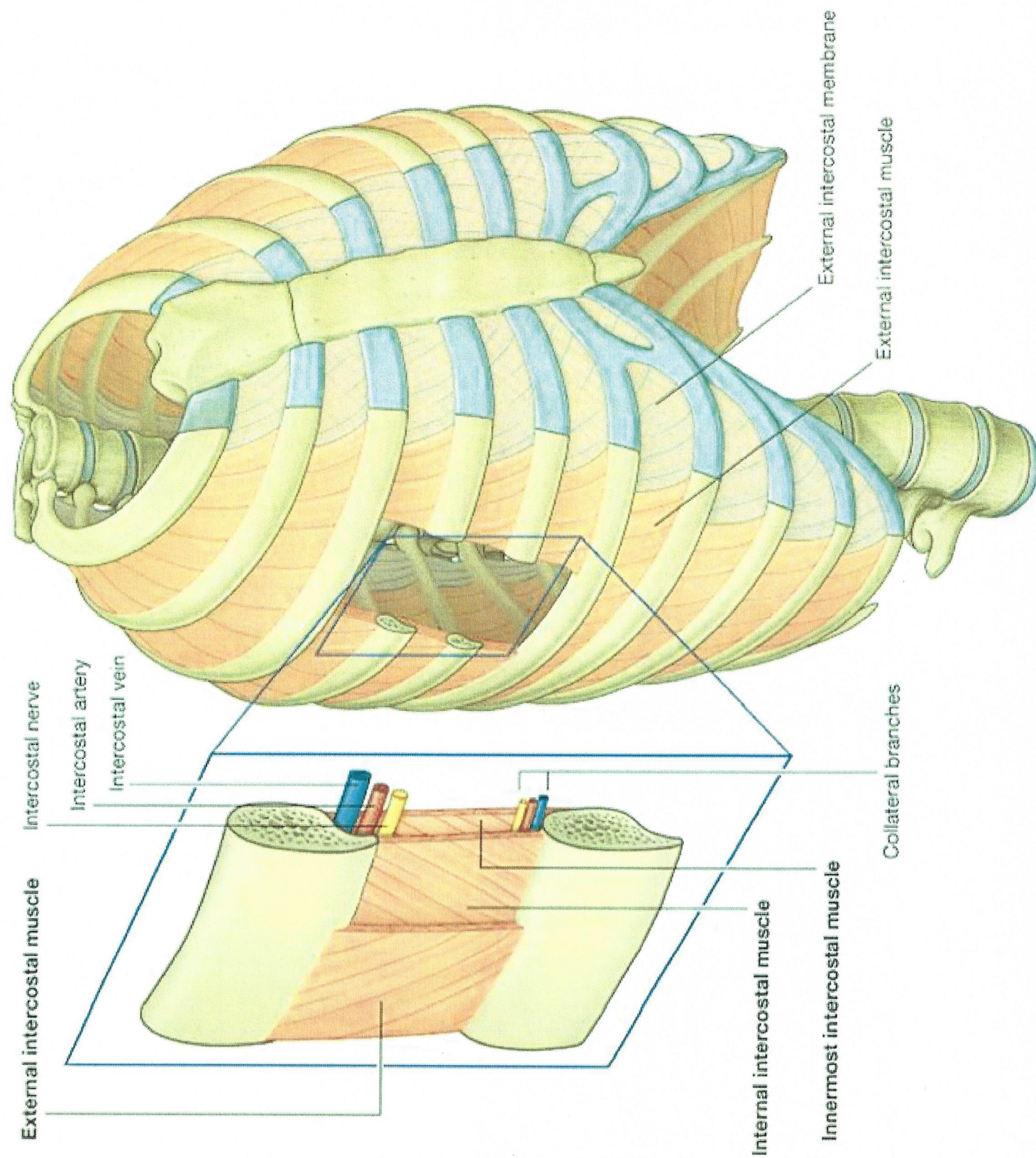
N.B - the first rib lies deep to clavicle and can not be palpated.



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THE INTERCOSTAL SPACE

- Spaces between each 2 successive ribs.
- they are 11 spaces on each side. [1st space below 1st rib, under the last rib (12) ^{there is} subcostal space]

* Structure :-

- each intercostal space contains :-
- 1- intercostal muscles (ext. , int. & innermost).
- 2- intercostal vein , artery & nerve (VAN).
- 3- endothoracic fascia.

A - Intercostal muscles

- They are arranged in 3 layers in each space -
- 1- outer layer :- external intercostal muscle.
- 2- middle " :- internal " " "
- 3- inner " :- innermost " " "

1. External intercostal ms :-

- It's fibers directed downward & forward.
- extends forward from rib tubercle (behind) to costochondral junction (front) where it replaced by anterior (external) intercostal membrane.
- origin :: inferior border of rib above.
- insertion :: superior " " " below

2) Internal intercostal ms :-

- Its fibers directed downward & backward
- Extends backward from sternum (front) to angle of rib (behind), where it is replaced by posterior (int). intercostal membrane
- origin :- from lower border of rib above (subcostal groove).
- insertion :- to upper " " below.

3) Innermost intercostal ms :-

- Incomplete muscle layer & crosses more than intercostal space.
- related externally to int. I.C. ms & internally to endothoracic fascia
- divided into :-

(A) Innermost intercostal (intercostalis intimus) :-

- from lower border of rib above.
- to upper " " below.
- Considered as deepest part of internal I.C. ms & the intercostal VAN run between it & internal I.C. ms
- direction of fibers as internal intercostal ms.

(B) Sternocostalis (transversus thoracis) :-

(by 4 or 5 slips)

- from lower 1/3 of post. surface of body of sternum & xiphoid process.
- to inner surface of 2nd - 6th costal cartilages. (run upward & laterally).

(C) subcostalis ms :-

- from inner surface of rib (medial to it's angle).
- to the 2nd or 3rd rib below.

* Nerve supply of I.C. muscles :- corresponding intercostal nerves.

* Action :-

- Inspiration (when fixing 1st rib → elevate others toward 1st rib),
- Expiration (when " 12th rib → depress " " 12th rib).

(NB : ext. I.C. ms → inspiration, Intr & innermost → expiration)

other ms. of thoracic wall :-

① Levator costarum :-

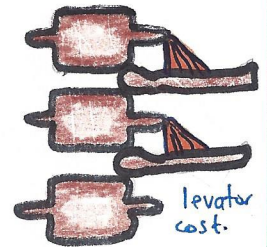
- 12 pairs of triangular muscles.

origin :- tip of transverse process.

insertion :- rib below.

N/S :- post. rami of thoracic spinal nerves.

action :- elevate rib below (inspiratory ms.).



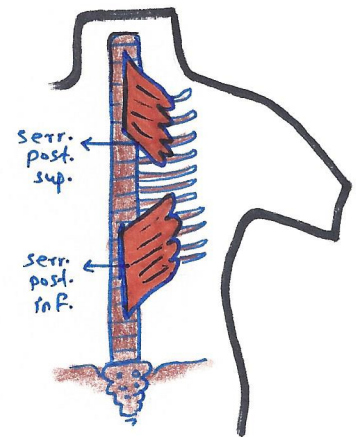
② Serratus post. superior :-

origin :- lower cervical & upper thoracic spines.

insertion :- upper ribs.

N/S :- intercostal nerves.

action :- elevate ribs (inspiratory ms.).



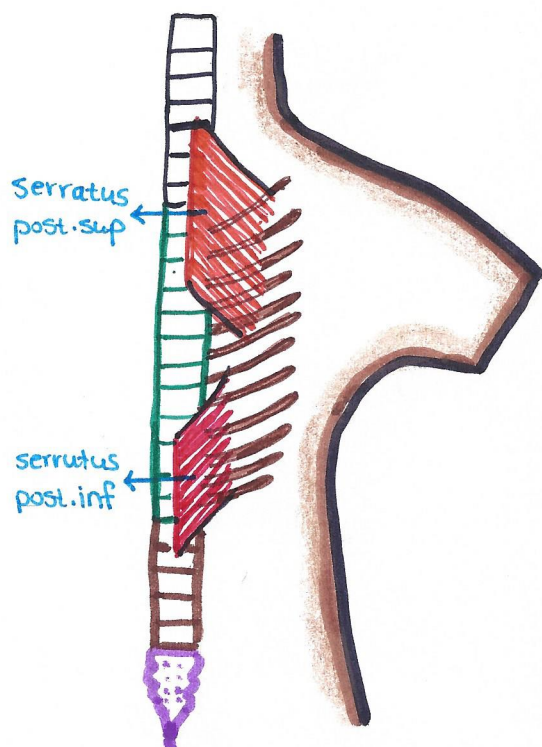
③ serratus post. inferior :-

origin :- lower thoracic & upper lumbar spines.

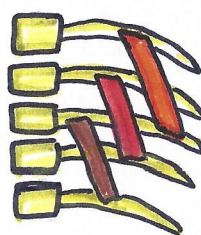
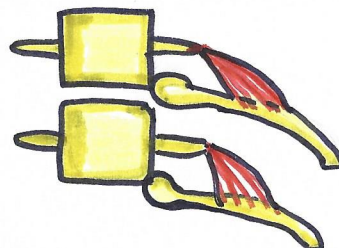
insertion :- lower ribs.

N/S :- intercostal nerves

action :- depression of ribs (expiratory ms.).



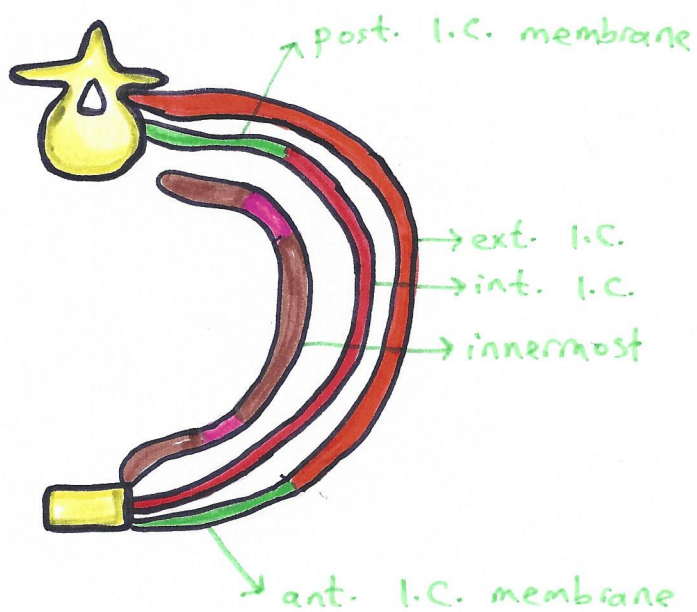
levator costarum



Subcostalis

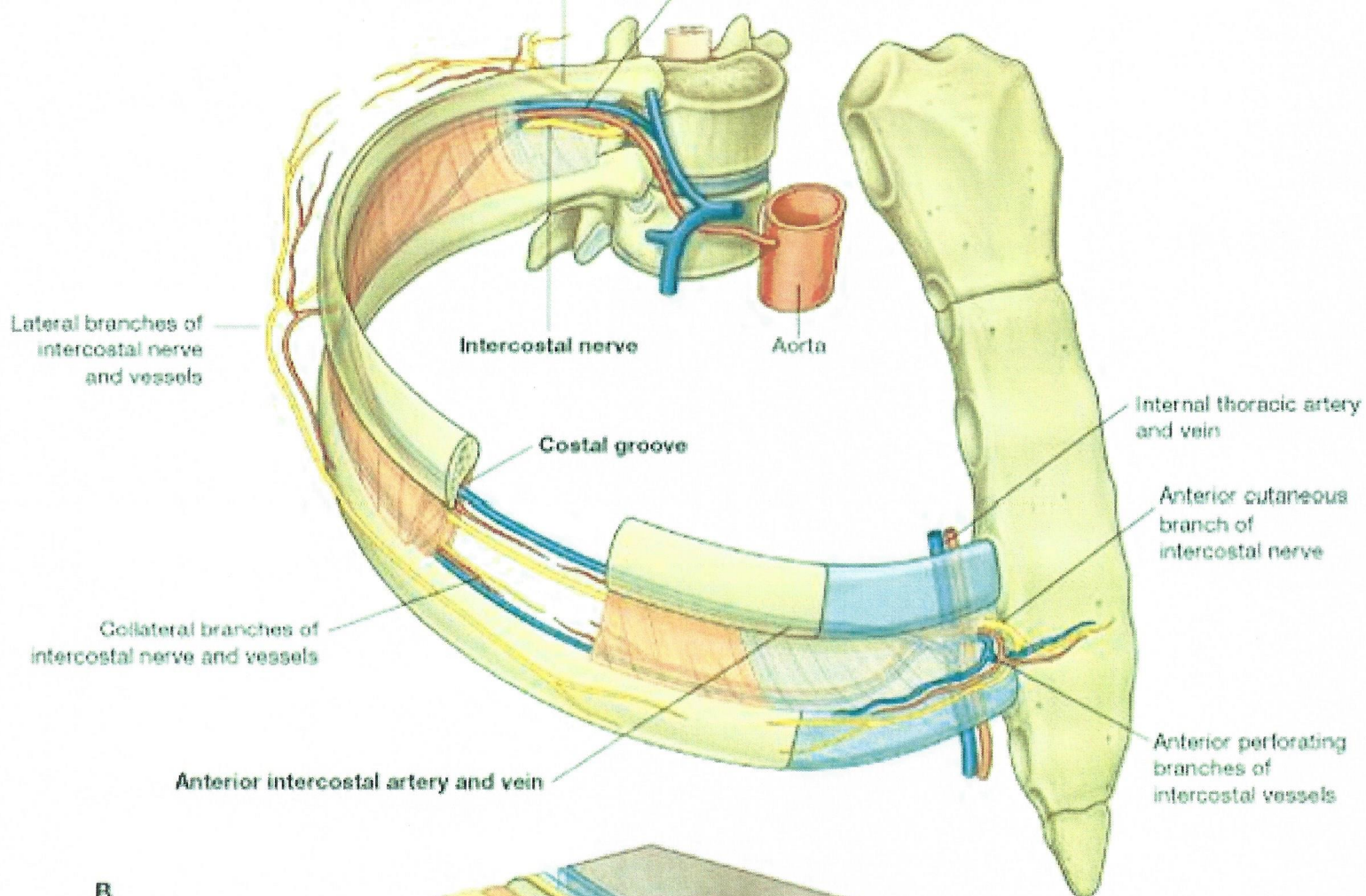


sternocostalis

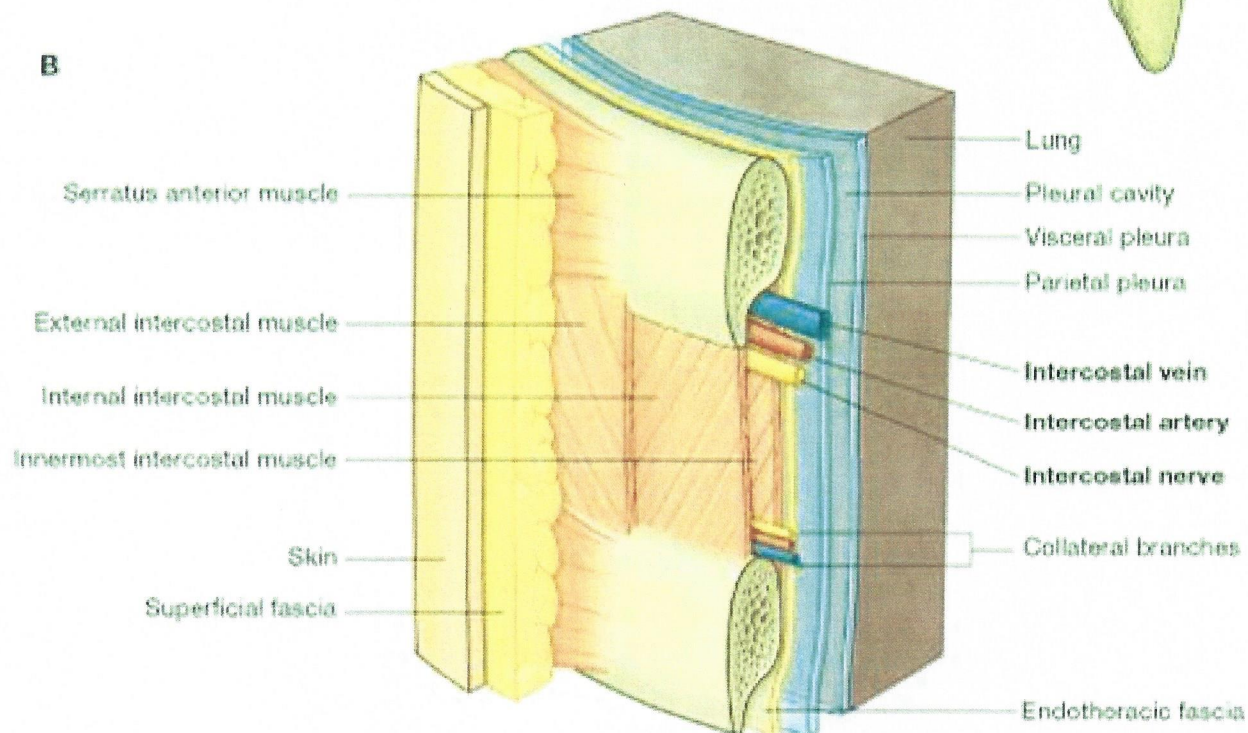


A

Posterior ramus of spinal nerve Posterior intercostal artery and vein



B



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B. Intercostal nerves

- The 11 intercostal nerves are ventral (ant) 1^{st} rami of 1^{st} 11 thoracic nerves (the ant. ramus of 12^{th} nerve lies in abdomen called subcostal n.)

* Classification :-

- ① Typical :- the 3^{rd} - 6^{th} nerves $\rightarrow$ supply only chest wall.
- ② Atypical :- 1^{st} & 2^{nd} nerves $\rightarrow$ supply chest & upper limb.
 - 7^{th} - 11^{th} nerves $\rightarrow$ " " wall & ant. abd. wall (^{thoraco-}abdominal)
 - 12^{th} (subcostal) nerve $\rightarrow$ " ant. abdominal wall & buttock skin.

NB: $7-9^{th}$ nerve pass under costal cartilage to enter ant. abd. wall.
 $10-11^{th}$ nerves pass directly to abdomen.

* Typical I.C. nerve :-

- Course & relation:- enter intercostal space between parietal pleura and post-intercostal membrane. (behind symp. chain).
- then, runs forward in subcostal groove of corresponding rib inferior to intercostal vessels (VAN), between internal intercostal and innermost (transversus) muscles
- ends as the ant. cut. nerve after piercing the internal intercostal m. & ant. intercostal membrane about $\frac{1}{2}$ inch lateral to the sternum.

- Branches :-

- ① ganglionic branches (grey & white rami communicantes) connect intercostal nerve to a ganglion of sympathetic trunk.
- ② Collateral branch (motor): runs on upper border of rib below. supplying intercostal muscles.
- ③ Muscular branches :- given by main nerve & its collateral branch
- ④ lateral cut- branches reach skin near midaxillary line & divides into ant. & post. branches
- ⑤ anterior cut. branches reach skin near midline (terminal br.) divided into medial & lateral branches.

⑥- Pleural (Parietal pleura) sensory branches.

⑦- articular branches: to joints of ribs.

NB:- nerves from 7th - 11th nerves supplies also skin & parietal peritoneum of ant. abdominal wall also muscles of ant. abd. wall (ext. oblique, int. oblique, transversus abdominis and rectus abdominis).

C-Intercostal arteries

- Each space contains single posterior intercostal & 2 anterior intercostal arteries.

A) Posterior intercostal a. :- (11).

- First 2 spaces :- branches from sup. intercostal artery branch of costocervical trunk of 2nd part subclavian artery.
- lower 9 spaces :- branches of descending thoracic aorta
 [NB:- subcostal artery also br. of descending aorta]
- **Course** :- each post. I.C. artery enters intercostal space in costal groove below the vein (VAN).
 - it gives a collateral branch runs along upper border of rib below
 - the post. I.C. & its collateral br. end by anastomosing with the 2 ant. intercostal arteries.
- **Branches** :-
 - ① dorsal branch :- supplies muscles & skin of back & gives spinal branch to spinal cord.
 - ② muscular branches.
 - ③ collateral branch.
 - ④ cutaneous branch.
 - ⑤ Pleural branches (to parietal pleura).
 - ⑥ Mammary branches (from 2nd, 3rd & 4th post I.C. arteries). female to breast

B) Anterior I.C. arteries :- (9)

- First 6 spaces :- branches from internal thoracic a.
- lower spaces (7th, 8th & 9th) :- from musculophrenic a., one of terminal branches of internal thoracic artery.

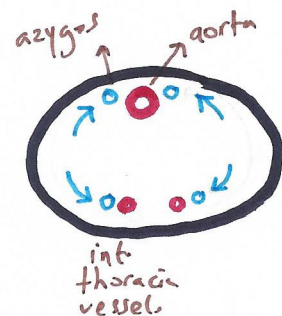
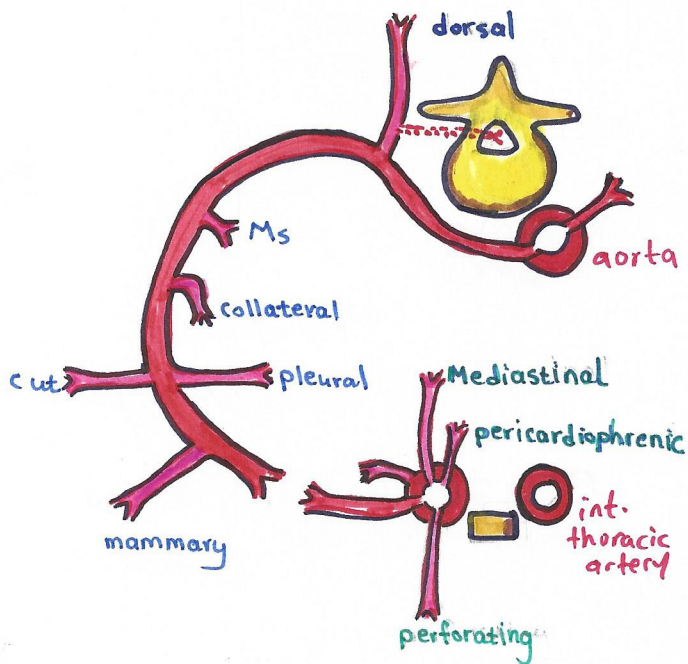
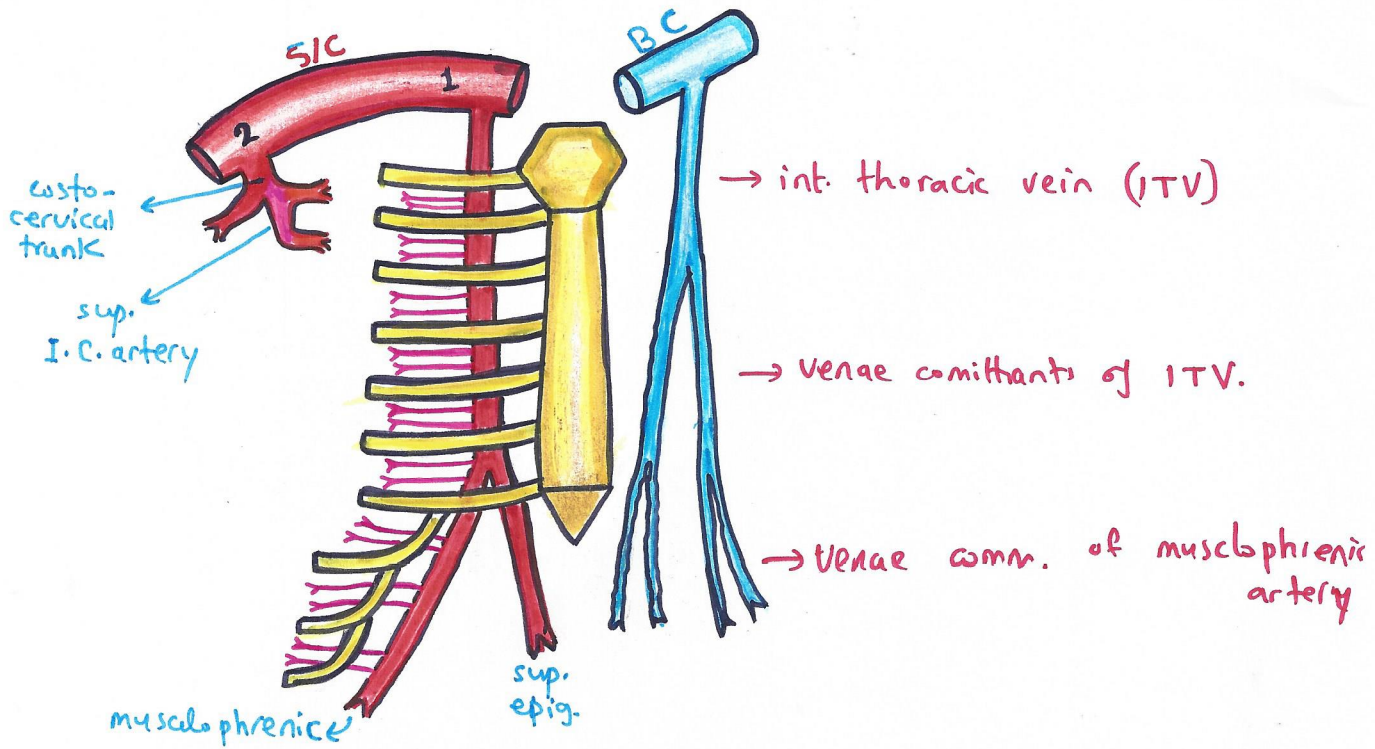
NB :- there are 2 anterior I.C. arteries in each of the upper 9 spaces (no ant. I.C. a. in the 10th & 11th spaces).

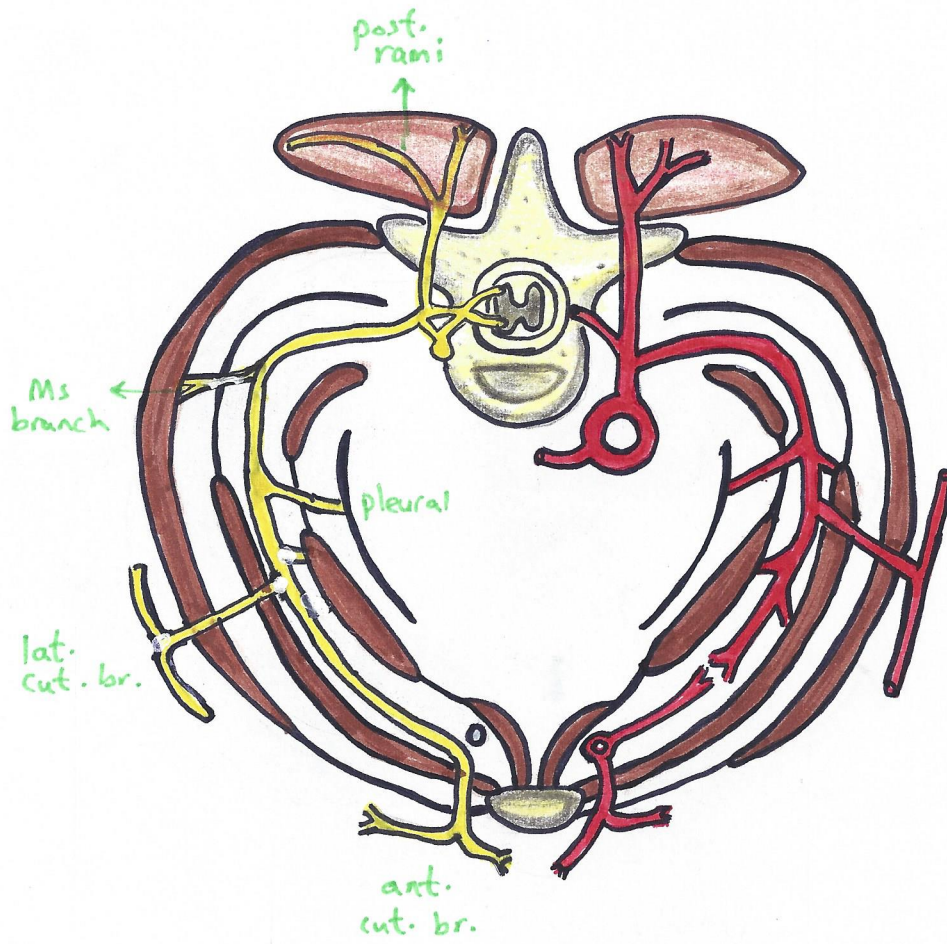
Internal thoracic "mammary" artery

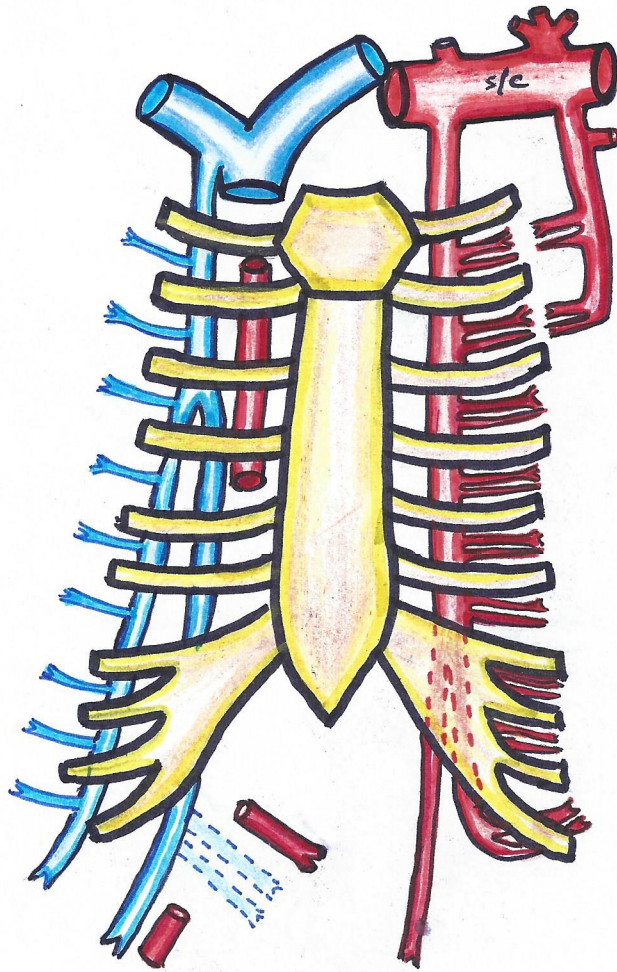
- * **Beginning** :- arise from 1st part of subclavian artery in neck.
[It supplies ant. body wall from clavicle to umbilicus]
- * **End** :- ends in the 6th intercostal space by dividing into 2 terminal branches (musculophrenic & sup. epigastric arteries)
- * **Course** :- descends vertically on pleura behind costal cartilages one fingerbreadth lateral to sternum.
- * **Branches** :-
 - ① Pair of ant. intercostal arteries to upper 6 I.C. spaces.
 - ② Perforating arteries :- accompany terminal branches of corresponding nerves (the 2nd → 4th supply breast).
 - ③ Pericardiophrenic artery :- accompanies phrenic nerve & supplies pericardium.
 - ④ Mediastinal arteries to contents of mediastinum.
 - ⑤ Musculophrenic artery :- runs around costal margin of diaphragm supplying lower intercostal spaces.
 - ⑥ sup. epigastric artery :- enters rectus sheath, supplies rectus muscle as far as umbilicus.

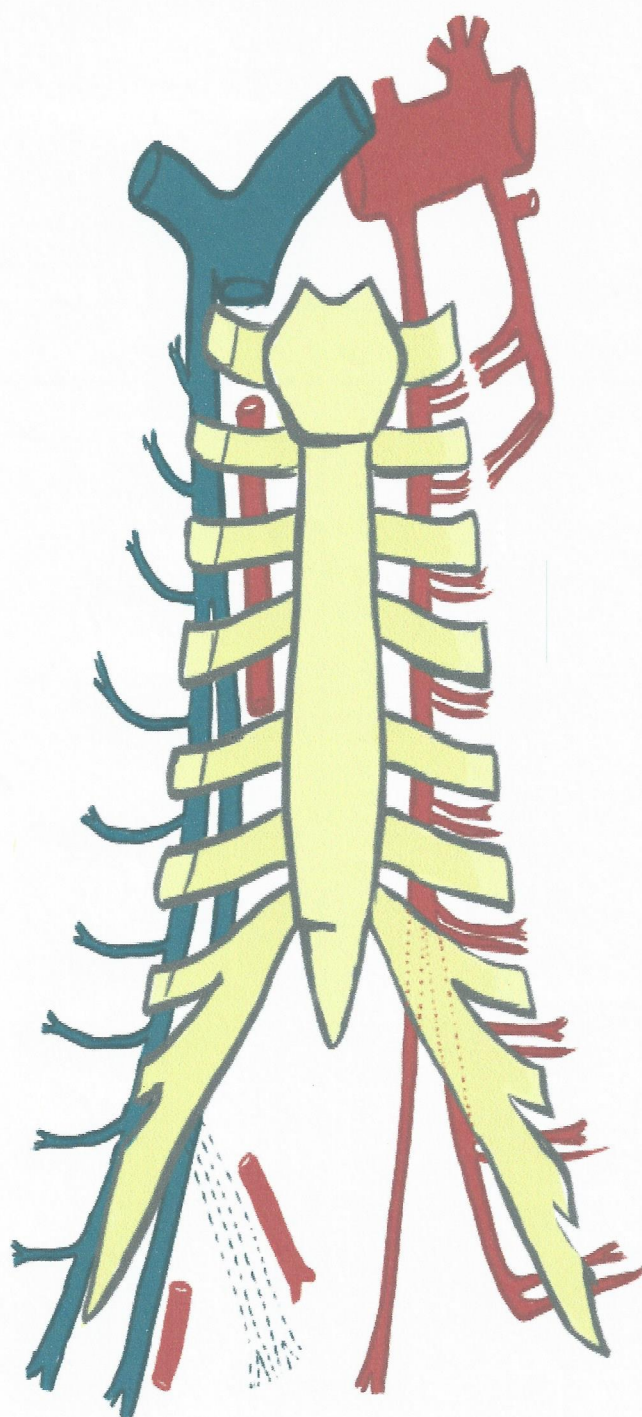
Internal thoracic vein :-

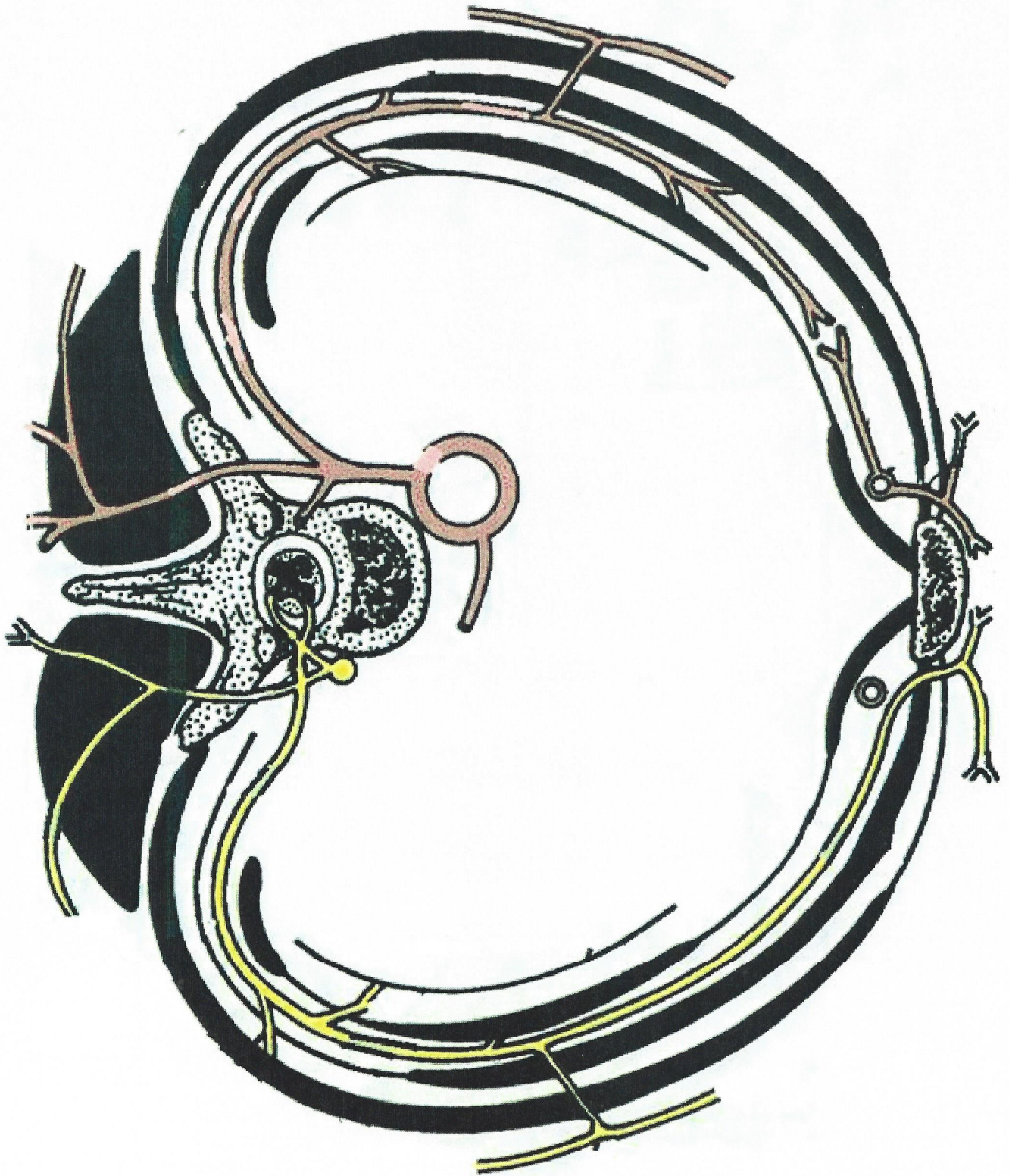
- **Beginning** :- at 3rd costal cartilage by union of 2 venae comitantes accompanying lower part of int. th. artery.
- **End** :- brachiocephalic vein.
- **tributaries** :-
 - ① Pair of ant. I.C. vein of upper spaces.
 - ② Perforating veins.
 - ③ Pericardiophrenic vein.
 - ④ Mediastinal veins.
 - ⑤ Venae comitantes of sup. epig. artery.
 - ⑥ " " " musculophrenic artery.











D - Intercostal veins

A - Anterior I.C. veins :- (pair in each space)

- the 7th, 8th & 9th spaces: → into venae comitantes of musculophrenic a.
- the 4th, 5th & 6th spaces: → " " " " int. thoracic artery
- the 1st, 2nd & 3rd spaces: → into the internal thoracic vein

B - Posterior I.C. veins :-

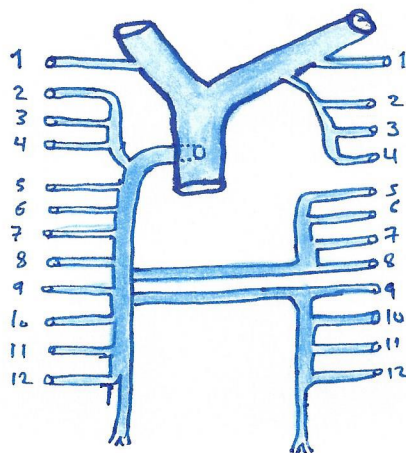
- there are 11 post I.C. veins on each side (one in each space)

① - on Right side :-

- the 1st post. I.C. vein → drain into Rt brachiocephalic (innominate) vein.
- the 2nd, 3rd & 4th veins → forms Rt sup. I.C. vein which drain to azygos arch.
- from 5th → 11th veins → to azygos vein.
- Subcostal vein: joins Rt ascending lumbar vein to form a trunk which joins azygos vein.

② - on Left side :-

- the 1st vein :- to Lt brachiocephalic (innominate) vein
- the 2nd, 3rd & 4th veins → forms Lt sup. I.C. vein → into Lt brachioceph. v.
- the 5th → to 8th veins → joins sup. hemiazygos.
- the 9th → to 11th veins → " inf. hemiazygos.
- subcostal vein: joins Lt ascending lumbar vein to form the inferior hemiazygos vein.



AZYGOS VEINS

- Consists of ① Main azygos vein.
- ② inferior hemiazygos vein.
- ③ superior " " vein. (accessory hemiaz.).
- Drain blood from - posterior parts of intercostal spaces.
- posterior abdominal wall.
- pericardium & diaphragm.

① Azygos vein (vena azygos) :-

• Beginning :- variable :-

- union of Rt ascending lumbar & Rt subcostal vein.
- mostly arises from back of IVC (opposite L₂).

at Rt side of descending aorta separated from it by thoracic duct

• Course :- ascends through aortic opening of diaphragm at level of T₁₂ vertebra, runs in posterior mediastinum then in the sup. mediastinum where it forms an arch at level of the 5th thoracic vertebra where it ends at level of the sternal angle (2nd Rt costal cartilage). (arches above root of Rt lung)

• End :- ends by draining into the back of S.V.C (sup. vena cava).

• Tributaries :-

- 1) Rt ascending lumbar.
- 2) Rt subcostal vein.
- 3) sup. hemiazygos vein.
- 4) Inf. " " vein.
- 5) Rt 7^{post} lower intercostal veins (5th → 11th).
- 6) Rt sup. intercostal vein.
- 7) Bronchial veins from Rt lung.
- 8) mediastinal veins, esophageal & pericardial veins.

Rt 8th
(4th - 11th)

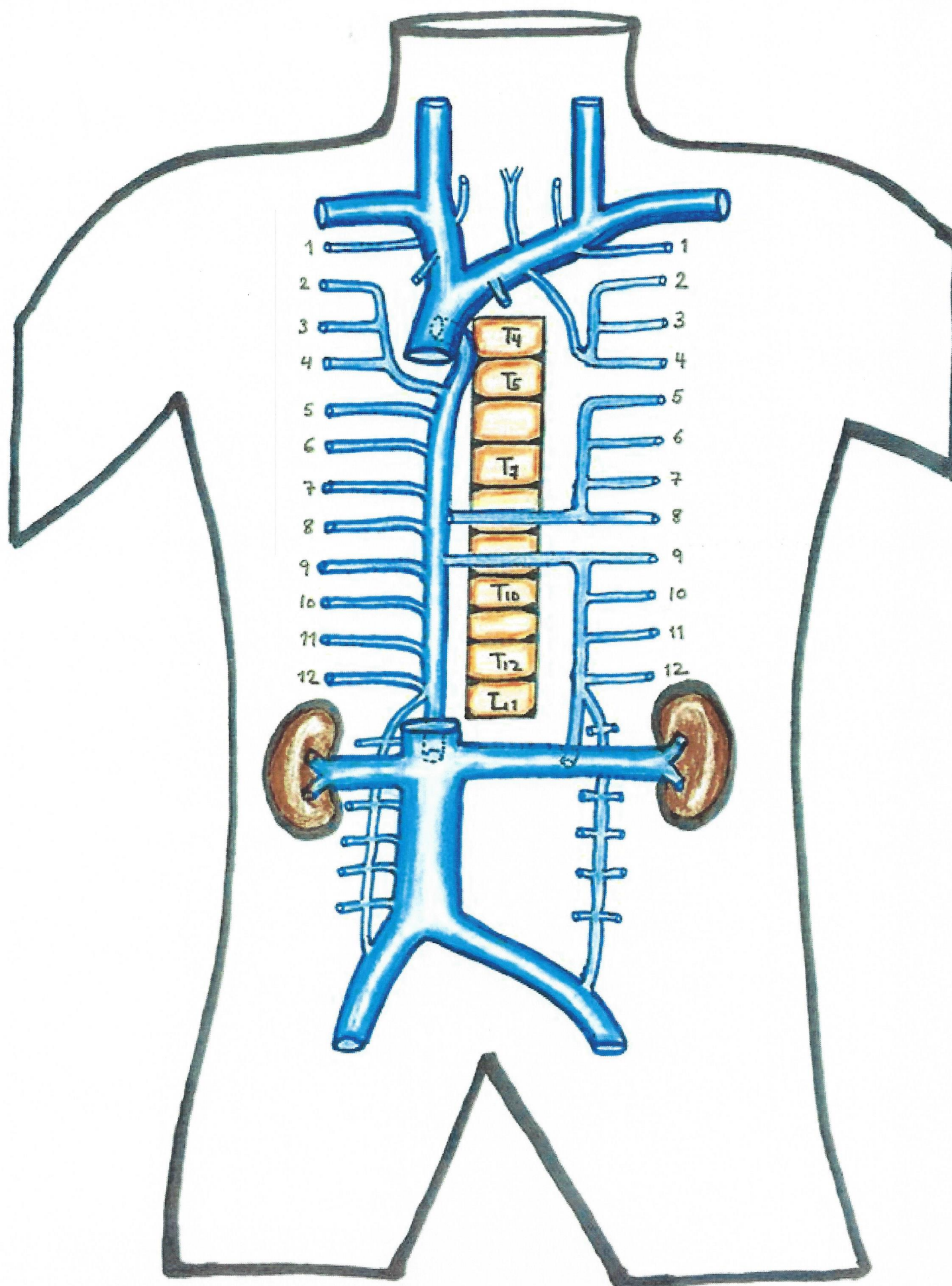
② Inf. hemiazygos vein :-

- **Beginning:-** - Union of Lt subcostal & Lt ascending lumbar veins.
- from the back of Lt renal vein (opposite L2).
- **Course:-** ascends through left crus of diaphragm. (K2)
- **End:-** ends by joining azygos vein at level of 9th thoracic vertebra.
- **Tributaries:-** 1) Lt post. intercostal veins 9th - 11th.
2) Lt subcostal & Lt ascending lumbar veins.

③ Sup. hemiazygos vein :-

- formed by union of the 5th - 8th intercostal veins. → 4th - 8th
- ends by joining the azygos vein at T8 vertebra.

(K2)



Suprapleural membrane

"Sibson's fascia"

- It is the upper thickened part of endothoracic fascia forming Tent-shaped fibrous sheet across the inlet on either side.
- Shape is triangular, having an apex & a base

• attachments:-

- Apex attached to tip of transverse process of C₇ vertebra.
- base attached to medial border of first rib & fascia investing the structures passing through inlet.

- ### • functions:-
- 1- protects underlying cervical pleura.
 - 2- resists intrathoracic pressure change (prevent inward suction & upward puffing).

- If damaged during dissection in the neck may lead to Pneumothorax.

NB:- Endothoracic fascia:- is a thin layer of loose C.T. lining thoracic cavity.



Cervical rib:-

- arises from ant. tubercle of transv. process of C₇ vertebra
- occurs in about 0.5% of people (1/200)
- may have free end or connected to 1st rib by fibrous band. or may articulate w 1st rib.
- It can cause pressure on lower trunk of brachial plexus causing pain along medial aspect of upper limb
- It can also cause pressure on subclavian artery → interfering with circulation of upper limb.

DIAPHRAGM

- It is a dome-shaped muscular & tendinous septum between thorax & abdomen.
- Consists of 1- peripheral muscular part
2- centrally placed tendon.

Shape of diaphragm :-

- As seen from front :- two domes (support Rt & Lt lungs) and central tendon (support heart).

1 - Rt dome :- reach upper border of 5th rib.

2 - Lt " :- " Lower " " 5th rib.

3 - Central tendon : xiphisternal joint.

- As seen from side :- inverted J shape.

1 - Long limb : extends up from vertebral column.

2 - Short " : " forward to xiphoid process.

* Origin :-

- Sternal part :- Rt & Lt slips from xiphoid process (post surface)
- Costal part :- 6 slips from deep surfaces of lower 6 ribs & their costal cartilages.
- Vertebral part :- ① Rt crus :- from sides of bodies of first 3 lumbar vertebrae & I.V discs.
② Lt crus :- from sides of bodies of first 2 lumbar vertebrae & I.V discs

* Median arcuate ligament :- connect 2 crura anterior to abd. aorta

* Medial arcuate lig. :- thickened psoas fascia extends from L₂ vertebral body to tip of trans. process L₁

* lateral arcuate lig. :- thickened fascia on quadratus lumborum m. extends from tip L₁ to rib 12

* Insertion :-

- Diaphragm inserted into central tendon.
(central tendon is shaped like 3 leaves, partially fused with fibrous pericardium).

NB:- some ms fibers of Rt crus pass up to Lt & surrounds esophageal orifice in sling like loop.

- act as sphincter.

- assist in prevention of regurgitation of stomach contents into thoracic part of esophagus.

* Nerve supply :-

- Motor :- phrenic nerve (C3,4,5).
- Sensory :- phrenic nerves :- supply parietal pleura & peritoneum covering central surface of diaphragm.
 - lower 6 ^{thoracic} ~~intercostal~~ (5 intercostal & subcostal) nerves supplies periphery of diaphragm.

* Action :-

- depression of central tendon.
- increase vertical diameter of thorax.

Function of diaphragm :-

- ① Ms of inspiration (most imp. ms).
- ② Ms of abdominal straining :- With anterior abd. wall ↑ intra-abd. pressure in urination, defecation, parturition, vomiting, sneezing, coughing, ...etc.
- ③ Weight-lifting ms :- assist ~~post~~ vertebral muscle in lifting heavy weights.
- ④ thoraco-abdominal pump :- compression of I.V.C and lymph in thoracic duct helping drainage (↓ intrathoracic pressure).

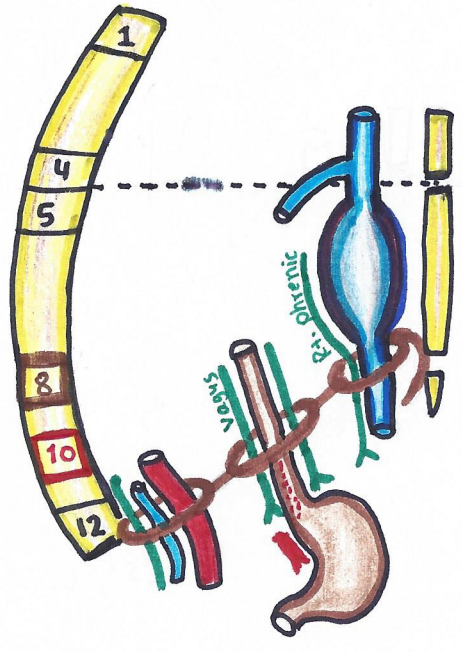
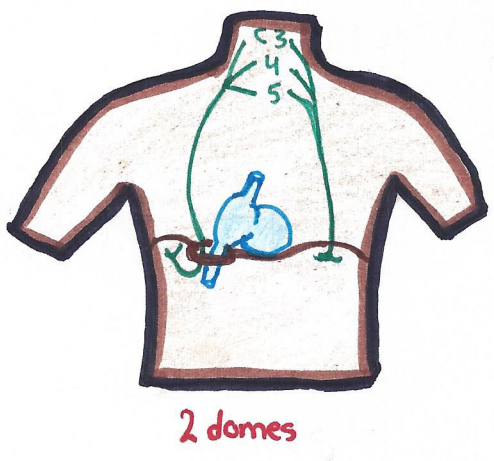
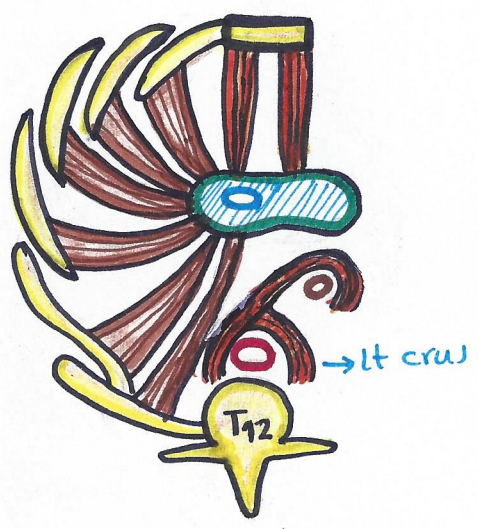
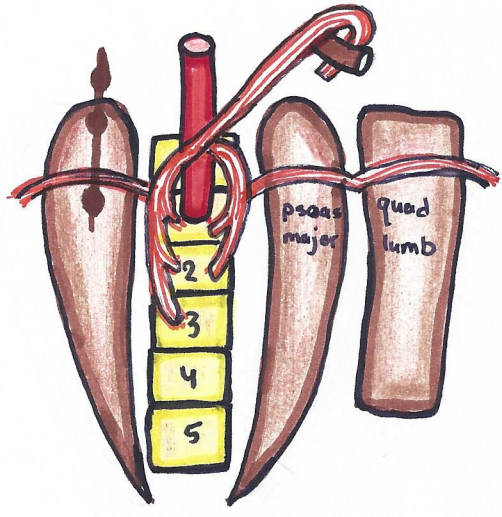
OPENINGS OF DIAPHRAGM :-

A-Major openings :-

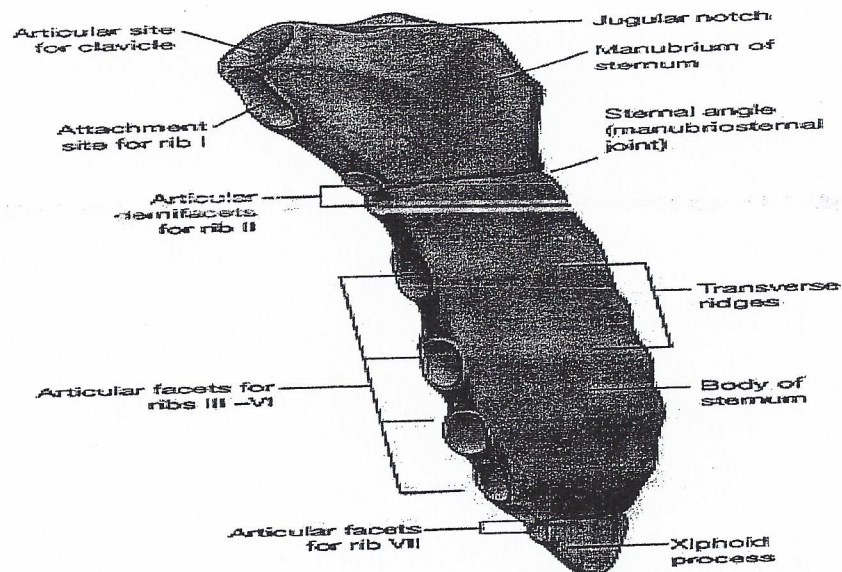
- ① Caval opening :- Lies at T₈ level, in central tendon
- Transmits :- ① I.V.C (inf. vena cava).
② Rt phrenic nerve.
- ② Oesophageal opening :- Lies at T₁₀ level, in Rt crus sling.
- Transmits :- ① Oesophagus.
② Rt & Lt ^(vagi) vagus nerves
③ esoph. branches of Lt gastric vessels
④ Lymph vessels to celiac LN.
- ③ Aortic opening :- Lies at T₁₂ (anterior to body of T₁₂)
between 2 crura (behind median arcuate lig)
- Transmits :- ① Aorta.
② Azygos vein.
③ Thoracic duct.

B-Minor openings :-

- ① Piercing the crura :- 1- greater splanchnic nerves.
2- lesser " " "
3- lowest " " "
- ② behind medial arcuate lig :- sympathetic trunks.
- ③ between sternal & costal origins :- superior epigastric vessels.
- ④ pierces Lt dome of diaphragm :- Lt phrenic nerve.
- ⑤ between muscular slips of costal origins :- neurovascular bundles (VAN) of 7th - 11th intercostal spaces.



Sternum



Sternum: consists of three part

1. manubrium
2. Body of sternum
3. Xiphoid process

Manubrium:

Upper part of sternum, flat four sided, broader above than below, it forms the anterior wall of superior mediastinum, articulates with the clavicle, and first and upper part of 2nd costal cartilage on each side.

. Body of sternum

Articulates above with Manubrium by manubriosternal joint and laterally On each side with Lower part of 2nd costal cartilage and 3rd -7th costal cartilages. And below

Xiphoid process:

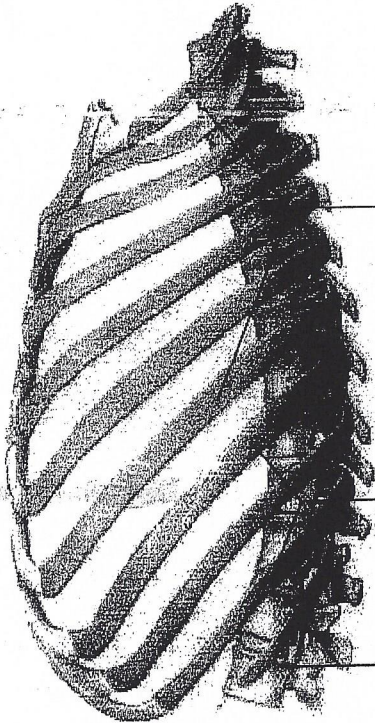
No ribs or costal cartilages are attached to it and articulates above with body at xiphisternal joint.

Applied :

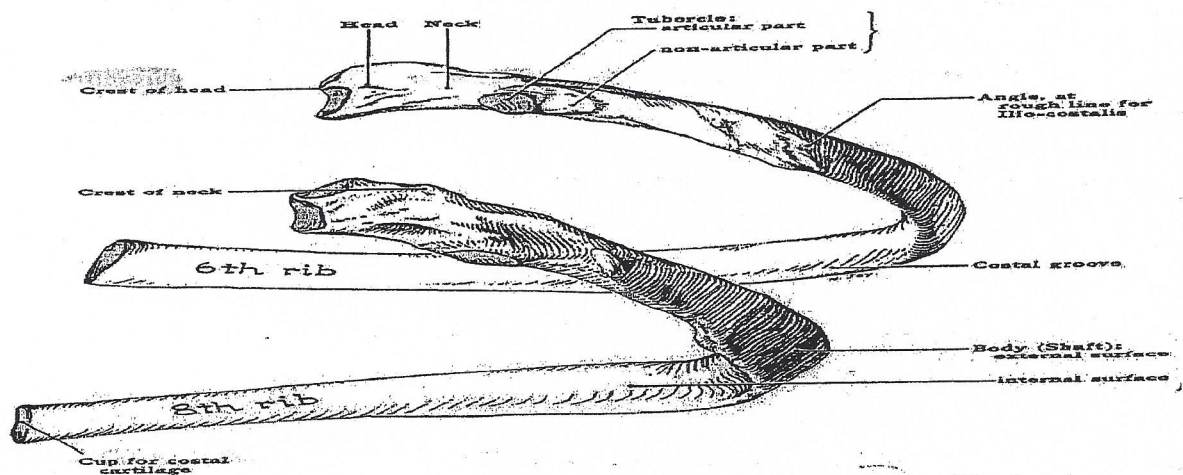
1. Sternum is the site for bone marrow biopsy.

2. Median sternotomy :

Sternum divided in the middle to gain access to thoracic cavity.

Ribs

Rib type	Ribs	Anterior articulation
True ribs	1-7	Sternum (costal notches)
False ribs	8-10	Rib above
Floating ribs	11, 12	None



1-3 TYPICAL RIBS, FROM BEHIND

Ribs: There are 12 pairs of ribs.

Classification:

According to their anterior attachments into:

1. True ribs:

1- 7 attached anteriorly to the sternum by their costal cartilage .

2.False ribs:

8, 9, and 10 pairs are attached anteriorly to each other and to the 7th rib by means of their costal cartilages

3.Floating ribs:

11th and 12th pairs, have no anterior attachment

According to their features into :

Typical rib: 3-10

long , twisted, flat bone, with head, neck and shaft.

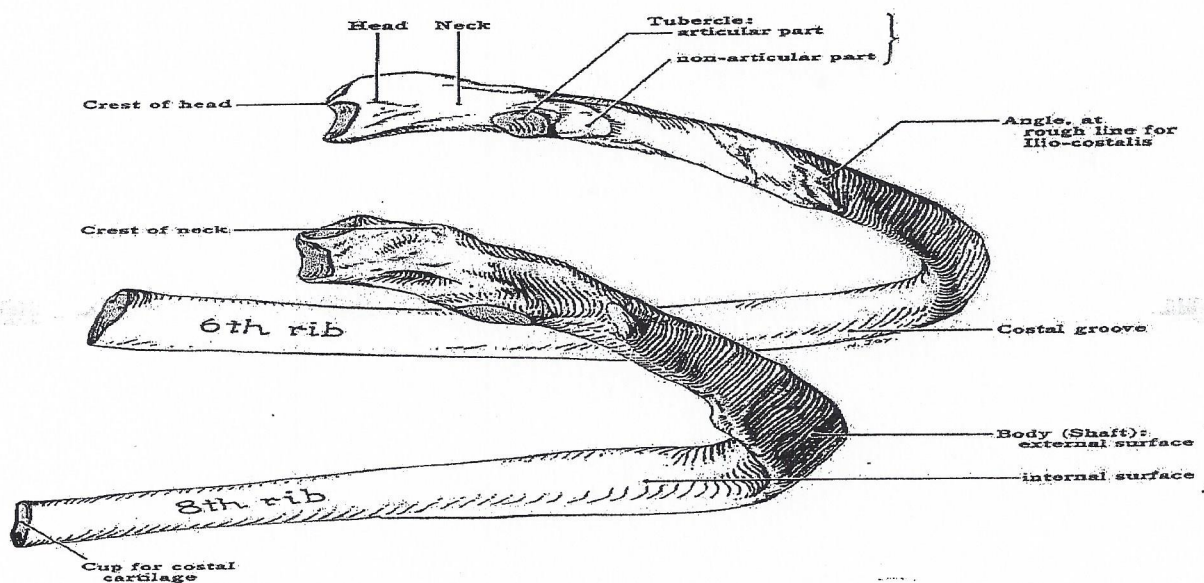
head with two facets, lower articulates with upper facet on body of corresponding vertebra.

Tubercle with articulates and non articulates parts.

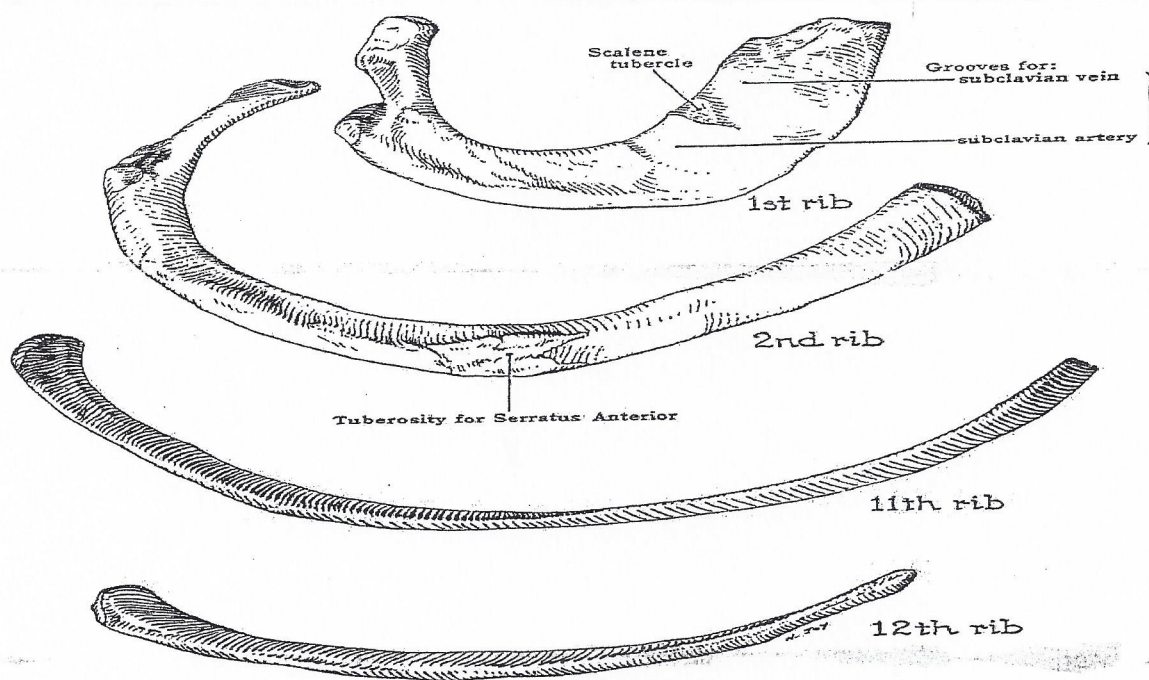
Shaft , has rounded , smooth superior border and a sharp , thin inferior border which form costal groove.

Angle, site where the shaft bends sharply.

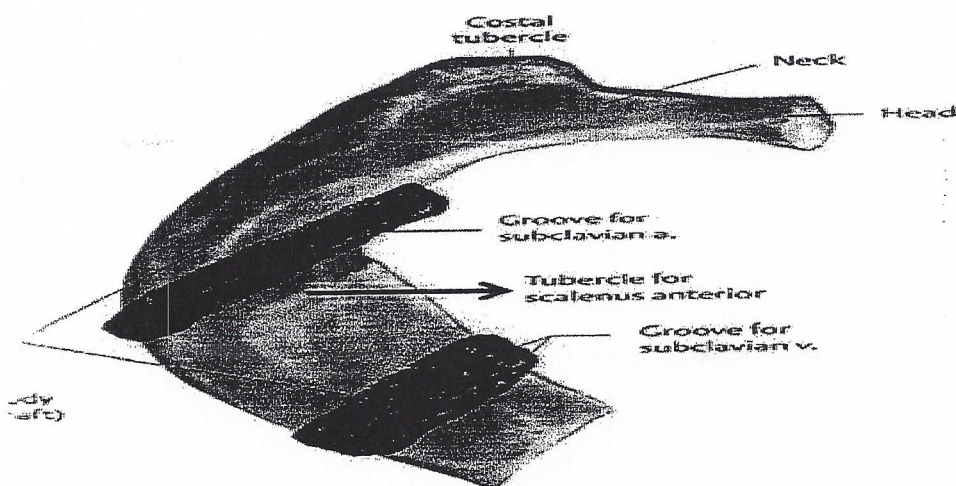
Anteriorly each rib ends by articulation with corresponding costal cartilage, forming primary cartilaginous joint.



1-3 TYPICAL RIBS, FROM BEHIND



1-5 ATYPICAL RIBS, FROM ABOVE



ATypical ribs : 1,2,11,12

1. First rib :

The strongest, broadest, flattest and more curved rib.

Head is small and carries a single facet, for the upper part of the body of T1 vertebra.

It has superior surface, with scalene tubercle between two grooves one for subclavian artery and other for subclavian vein, and inferior surface.

2. second rib:

Twice the length of first , and with similar curvature , slight angle , shaft not twisted , external surface is convex and rough , the internal surface is smooth and concave , it has short subcostal groove.

3. Eleventh rib:

has head with single facet for T11 vertebra, short neck, no tubercle, slight angle and shallow costal groove.

4. Twelfth rib:

head has single facet for T12 vertebra, no tubercle, no angle, no costal groove.

Costal cartilages:

Form with all ribs primary cartilaginous joint at the extremities, of all ribs.

The first is short and thick, below it the cartilage increase in length down to the 7th which is the longest, and from the 5th to 10th they are bent upward toward the sternum or the cartilage above.

The cartilage of 11 and 12 have free pointed anterior ends.

All cartilages especially the first , tend to calcify and even ossify in patches after middle age.

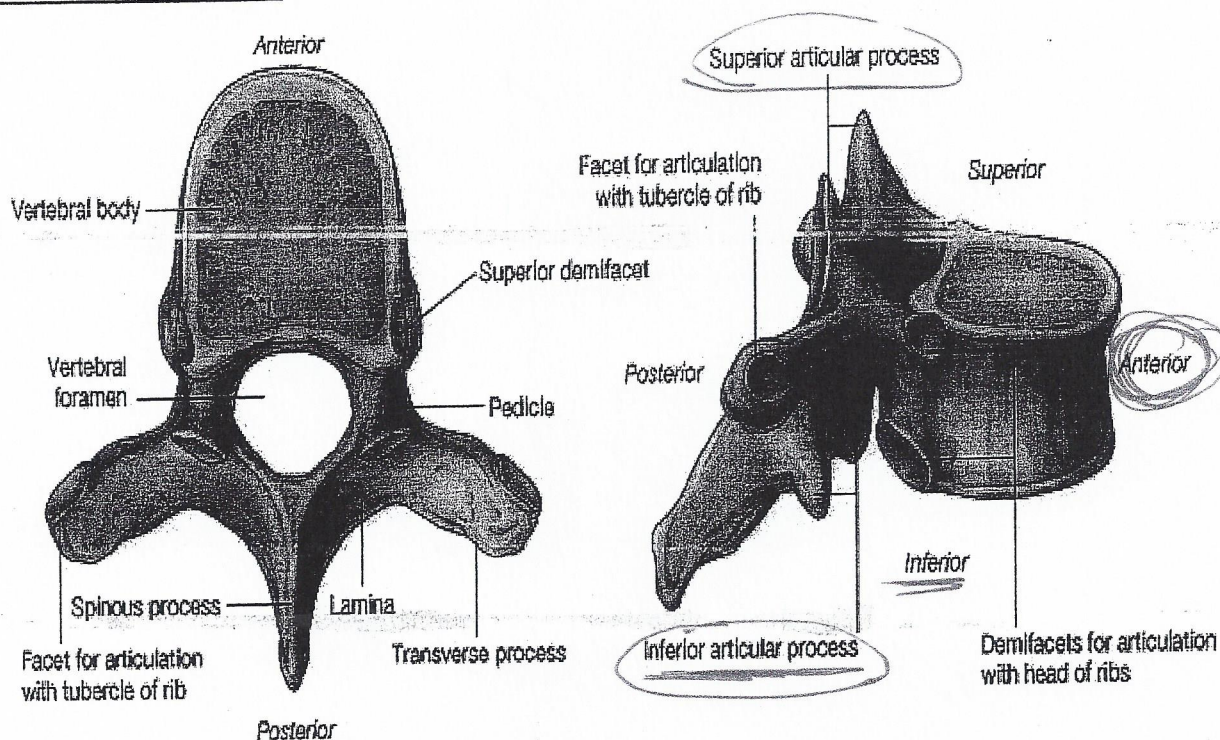
Applied :

Cervical rib :

lead to compression of C8 and T1 and this lead to pain on the medial side of forearm, hand and wasting of the small muscles of the hand . numbness and weakness.

And may also Compression of the subclavian artery and lead to pallor and coldness of the skin of upper limb.

3. Thoracic vertebrae:



Thoracic vertebra :

There are 12 thoracic vertebrae, each has articulation with ribs.

Feature :

1. Body, heart shaped, with two demifacet, the upper articulates with corresponding lower rib facet.
2. Vertebral foramen is circular.
3. long spinous process.
4. lamina are broad .
- 5 . Superior articular process is flat, and facing posteriorly.
6. Inferior articular process with their articular facets face anteriorly.
7. Transverse process project posterolaterally, with facet for articulation with tubercle of the rib.

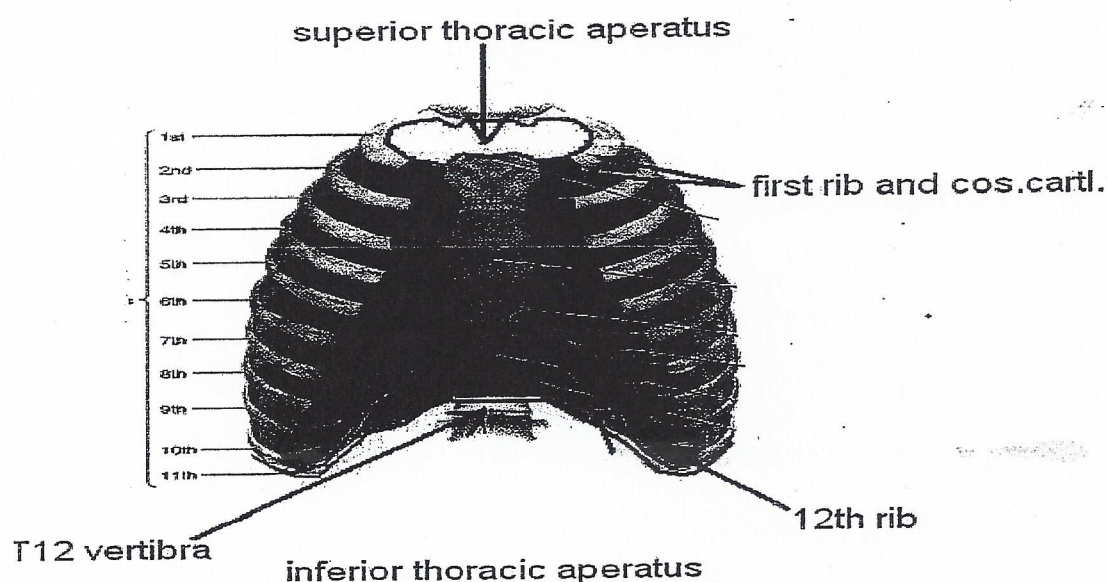
Sites of articulations with ribs

1. Two demifacet on the body, Superior with the lower fact on the head of corresponding rib.

inferior with head of the rib below.

2. Oval facet (transverse costal facet) at the end of the transverse process articulate with the tubercle of its own rib.
3. Superior articular process with inferior articular process of vertebra above .
4. Inferior articular process with the superior articular process of vertebra below.

Openings of the Thorax



Superior thoracic aperture (thoracic inlet) :

Communication between root of the neck and thoracic cavity.

Oblique facing upward and forward, and about 6 cm AP and 12 cm in transverse diameter.

Boundaries of thoracic inlet:

Posterior: First thoracic vertebra

Lateral: Medial borders of first ribs and their costal cartilages

Anterior: Superior border of manubrium sterni

Joints of thorax wall

Joints of the sternum

1. Manubriosternal joint:

Symphysis or (secondary cartilaginous) and only small amount of angular movement is possible during respiration.

2. xiphisternal joint :

Symphysis, between the xiphoid process and the body of the sternum, it lies opposite to body of 9th thoracic vertebra.

Sternocostal joints:

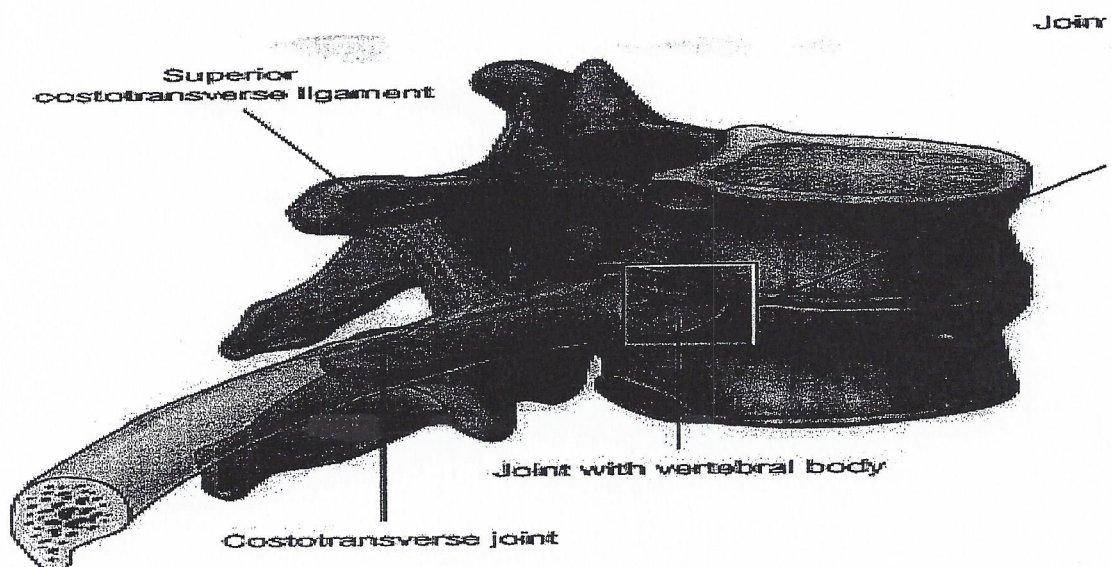
1st rib. With the manubrium no movements (primary cartilaginous).

2nd rib . Synovial joint With both manubrium and body , with movements.

3rd-7th ribs : synovial joint with lateral border of sternum .

6-10 ribs : (interchondral joints)

Articulates with each other along their border by small synovial joints .



Costovertebral joints:

1. joints of the head of the ribs :

The head of the ribs articulates by means of synovial joint on the body of the corresponding vertebra and on the vertebra above.

NB : 1st, 11, 12 ribs have only a single joint with its corresponding vertebra.

2. Costotransverse joints : synovial joint between the tubercles of the ribs, with transverse process of corresponding vertebra (not on 11, 12 ribs).

Functions of thorax wall:

1. Protects vital organs (lungs, heart, spinal cord and major neurovascular bundles).
2. Gives attachment for muscles of thorax .
3. Helps in respiration.